

## CLAIMS

We claim:

- 1 1. An optically clocked optoelectronic track and hold apparatus, comprising:
  - 2 a) a diode bridge comprising a first node, a second node, a third node, a fourth node and a  
3 plurality of diodes;
  - 4 b) an input node, operatively coupled to said first node of said diode bridge, capable of  
5 receiving an analog input signal;
  - 6 c) at least two current sources, operatively coupled to said second node of said diode bridge  
7 and said third node of said diode bridge, and wherein said at least two current sources are  
8 capable of forward biasing said diode bridge;
  - 9 d) at least two photodetectors, operatively coupled to said second node and said third node  
10 of said diode bridge, capable of receiving an optical input clocking signal, and capable of  
11 reverse biasing and forward biasing said diode bridge in response to said optical input  
12 clocking signal;
  - 13 e) a hold capacitor, operatively coupled to said fourth node, capable of tracking said analog  
14 input signal when said diode bridge is forward biased, and capable of holding said analog  
15 input signal when said diode bridge switches from forward biased to reverse biased.
- 1 2. The optically clocked optoelectronic track and hold apparatus of Claim 1, wherein said at  
2 least two current sources comprises a first current source and a second current source, and  
3 wherein said first current source is operatively coupled to said second node and said second  
4 current source is operatively coupled to said third node.
- 1 3. The optically clocked optoelectronic track and hold apparatus of Claim 1, wherein said at  
2 least two photodetectors are reverse biased by voltage sources.
- 1 4. The optically clocked optoelectronic track and hold apparatus of Claim 1, wherein said at  
2 least two photodetectors comprises a first photodiode and a second photodiode, and wherein  
3 said first photodiode is operatively coupled to said second node and said second photodiode  
4 is operatively coupled to said third node.

- 1 5. The optically clocked optoelectronic track and hold apparatus of Claim 3, wherein said  
2 optical input clocking signal comprises a first optical input clocking signal and a second  
3 optical input clocking signal, wherein said first photodiode is capable of receiving said first  
4 optical input clocking signal, and wherein said second photodiode is capable of receiving  
5 said second optical input clocking signal, and wherein said first optical input clocking signal  
6 and said second optical input clocking signal are synchronized.
- 1 6. The optically clocked optoelectronic track and hold apparatus of Claim 1, wherein said at  
2 least two photodetectors have fast rise times and long fall times.
- 1 7. The optically clocked optoelectronic track and hold apparatus of Claim 1, wherein said at  
2 least two photodetectors switches said diode bridge from forward biased to reverse biased  
3 when said optical input clocking signal illuminates said at least two photodetectors with an  
4 optical pulse.
- 1 8. The optically clocked optoelectronic track and hold apparatus of Claim 1, wherein said at  
2 least two photodetectors switches said diode bridge from reverse biased to forward biased  
3 when said at least two photodetectors do not generate enough photocurrent to reverse bias  
4 said diode bridge.
- 1 9. The optically clocked optoelectronic track and hold apparatus of Claim 1, wherein said  
2 optically clocked optoelectronic track and hold apparatus is configured into a positive node  
3 device and a negative node device, wherein said optically clocked optoelectronic track and  
4 hold apparatus receives said analog input signal and an inverted analog input signal and  
5 outputs a differential output signal.
- 1 10. The optically clocked optoelectronic track and hold apparatus of Claim 1, wherein said  
2 optically clocked optoelectronic track and hold apparatus further comprises an amplifier,  
3 operatively coupled to said hold capacitor, capable of outputting a first TH output signal.
- 1 11. The optically clocked optoelectronic track and hold apparatus of Claim 10, wherein said  
2 optically clocked optoelectronic track and hold apparatus further comprises a quantizer,  
3 operatively coupled to said amplifier, capable of quantizing said first TH output signal and  
4 outputting a digital output signal.

- 1 12. The optically clocked optoelectronic track and hold apparatus of Claim 10, wherein said  
2 optically clocked optoelectronic track and hold apparatus further comprises an electronic  
3 track and hold device, operatively coupled to said amplifier, capable of receiving said first  
4 TH output signal and an electronic clock signal, and wherein said electronic track and hold  
5 device is capable of outputting a second TH output signal.
- 1 13. The optically clocked optoelectronic track and hold apparatus of Claim 1, wherein a  
2 photodetector of said at least two photodetectors comprises a short transit time photodiode  
3 and a long transit time photodiode in a parallel configuration.
- 1 14. The optically clocked optoelectronic track and hold apparatus of Claim 13, wherein said  
2 short transit time photodiode and said long transit time photodiode are focus illuminated in I  
3 regions near junctions between P regions and N regions.
- 1 15. A method for optically clocked optoelectronic tracking and holding, the method comprising  
2 the steps of:
- 3 a) receiving an analog input signal and an optical input clocking signal;
- 4 b) determining whether an optical pulse is received by at least two photodetectors from said  
5 optical input clocking signal;
- 6 c) maintaining a diode bridge in forward bias and returning to STEP (a) if said optical pulse  
7 is not received from said optical input clocking signal;
- 8 d) switching said diode bridge to reverse bias for a desired time and returning to STEP (a) if  
9 said optical pulse is received from said optical input clocking signal.
- 1 16. The method of Claim 15, wherein said switching said diode bridge to reverse bias for a  
2 desired time step comprises the following sub-steps:
- 3 i) generating photocurrent sufficient to reverse bias said diode bridge if said optical  
4 pulse is received from said optical input clocking signal;
- 5 ii) maintaining sufficient photocurrent to reverse bias said diode bridge for said desired  
6 time;

7           iii) switching said diode bridge to forward bias when photocurrent becomes insufficient  
8           to reverse bias said diode bridge;

9           iv) returning to STEP (a) of Claim 15.

1   17. The method of Claim 15, wherein said maintaining diode bridge in forward bias step  
2   comprises forward biasing said diode bridge by said at least two photodetectors not  
3   generating enough photocurrent.

1   18. The method of Claim 15, wherein said switching said diode bridge to reverse bias for said  
2   desired time step comprises reverse biasing said diode bridge by said at least two  
3   photodetectors quickly switching to an on-state.

1   19. The method of Claim 15, wherein said switching said diode bridge to reverse bias for said  
2   desired time step uses a long transit time photodiode to maintain sufficient photocurrent for  
3   said desired time.

1   20. An optically clocked optoelectronic track and hold apparatus, comprising:

2       a) means for receiving an analog input signal and an optical input clocking signal;

3       b) means for determining whether an optical pulse is received by at least two photodetectors  
4       from said optical input clocking signal;

5       c) means for maintaining a diode bridge in forward bias if said optical pulse is not received  
6       from said optical input clocking signal;

7       d) means for switching said diode bridge to reverse bias for a desired time if said optical  
8       pulse is received from said optical input clocking signal.